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THESIS

THE SUPPLY OF NROTC MIDSHIPMEN

by

Billy LaRoy Lewis

December 1980

Thesis Advisor: J. K. Arima

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#20 - ABSTRACT - (CONTINUED)

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The Supply of NROTC Midshipmen

by

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Lieutenant Commander, United States Navy
B.S., United States Naval Academy, 1969

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

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December 1980

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INTRODUCTION

GENERAL

The mission of the Reserve Officer Training Corps on college campuses is to recruit and train young men and women who represent a broad cross section of the nation's college students. Upon commissioning, ROTC-trained officers ensure a strong tie between the civilian sector and the officer corps. As opposed to the Army, which relies on ROTC as its major source of new officers, the Navy receives its major input of new officers from Officer Candidate School. Since the input from OCS provides a sufficient number of officers with nontechnical degrees, the Navy has been able to further refine the role of the Naval Reserve Officer Training Corps (NROTC) as being the major source of officers possessing technical backgrounds (Department of Defense Report, 1980).

The NROTC is subdivided into the Scholarship and College Programs, the major distinction being that College Program enrollees receive no scholarship, are commissioned as reserve officers, and must serve three years on active duty. Scholarship Program participants, on the other hand, receive tuition, books and fees in addition to uniforms, are paid for cruises, and receive a subsistence allowance of $100 per month for a maximum of 40 months. They receive a regular commission and must serve at least four years on active duty. Although there are four-, three-, two-, and one-year scholarships

available under a variety of options, including transfer from the College to Scholarship Program, this study will deal exclusively with four-year scholarship holders, since that population constitutes the majority of NROTC enrollment, is subject to the most intensive pre-enrollment screening, and represents the largest cost in dollars.

BACKGROUND

In order to ensure that NROTC fulfills its role as the major supplier of officers holding technical degrees, the Navy has enacted two controls on the mix of scholarship students enrolling each year. The most recent specification stated that 80 percent of Navy scholarship students must major in chemistry, math, physics, or engineering, while the remaining 20 percent is allowed to major in liberal arts, as long as the curriculum has naval service relevance (Naval Reserve Officer Training Corps Education and Training Policy, 1976). Furthermore, all scholarship holders are required to complete one year of calculus and one year of physics, and liberal arts majors must complete two additional science/engineering courses. The level of 80 percent was arrived at as that input level necessary to achieve an output four years later that would consist of 60 percent technical majors (NROTC Program--Status Report, 1979). This policy governing the technical/nontechnical mix has come to be referred to as "80/20" and is the subject of continuing debate and evaluation.

As stated by the Chief of Naval Operations, 80/20 was enacted in order to meet the demands of increasing technological complexity in military hardware. An added benefit was anticipated in producing a population of officers trained in the analytical and logical approach to problem-solving inherent in a technical discipline (NROTC Education and Training Policy, 1976). The Chief of Naval Personnel (NROTC POA&M, 1977) expressed the opinion that improvement in the technical background of NROTC graduates occasioned by 80/20 would augment the badly depleted base of potential postgraduate students and nuclear power candidates. The connection between NROTC and the Nuclear Power Program may be the underlying motivation behind 80/20 (BDM Corporation, 1978). As shown in Table 1, accessions to the Nuclear Power Program from NROTC have almost doubled as a percentage of the total annual nuclear power accessions since 1977 and are projected to exceed the number produced by the Naval Academy in 1980. As might be expected, Admiral Rickover, the Director, Division of Naval Reactors, is strongly in favor of 80/20, given the highly technical nature of nuclear power training and nuclear power operational billets. His opinions do not seem to be shared by all parties involved, however. The November 1976 meeting of the Association of NROTC Colleges and Universities included an acrimonious debate over the newly promulgated 80/20 policy, with the majority of the representatives being against the policy (Core Curriculum Concept,

TABLE 1

NUCLEAR POWER ACCESSIONS
BY COMMISSIONING SOURCE
(Percentage of TOTAL in parenthesis)

Source		1976[a]	1977	1978	1979	1980[b]
USNA	submarine		154	171	119	161
	surface		53	38	72	67
			207(45)	209(38.4)	191(34.5)	228(40)
NROTC	submarine		94	132	145	165
	surface		17	26	33	87
			111(24.1)	158(29)	178(32.2)	252(44.1)
OTHER[c]	submarine		131	168	170	90
	surface		12	9	14	1
			143(30.9)	177(32.6)	184(33.2)	91(15.9)
TOTAL[d]	submarine	464	379	471	436	416
	surface	76	82	73	117	115
			461(100)	544(100)	553(100)	571(100)
GOAL[e]	submarine	568	568	680	680	655
	surface	84	91	101	103	103
SHORFALL[f]	(%)	17.2	30	30.4	29.4	24.7

[a] Individual source data not available [b] projected

[c] Includes the Nuclear Power Officer Candidate Program, NESEP, and interservice transfer

[d] Total new accessions [e] Number required to begin Nuclear Power School

[f] Total accessions versus GOAL

1978). Objections within the Association appeared to stem from a belief that 80/20 discouraged participation in NROTC by students in nontechnical majors since their competition for scholarships is severely constrained. The Assistant Secretary of the Navy (Manpower, Reserve Affairs and Logistics) also expressed the concern that 80/20 might result in discrimination against minority students (NROTC Program--Status Report, 1979).

The second constraint on scholarship mix enacted by the Navy dictates that 80 percent of all scholarship applicants selected must have attained at least a combined Scholastic Aptitude Test (SAT) verbal and mathematics score of 1200 and a minimum mathematics score of 650. For applicants establishing eligibility through the American College Test (ACT) this requirement was equated in 1977 to a minimum composite score of 27, with a minimum mathematics score of 28 (Precept for 1977 NROTC Scholarship Program, 1977). This "80/20" requirement has evolved over time as reflecting the desired academic quality of the NROTC input. It must be emphasized that the 1200/650 SAT requirement is separate and distinct from the 80/20 technical mix criterion. The two requirements are believed to be somewhat interactive, however. Experience has shown that a student able to achieve a mathematics score of 650 will have a decided propensity for technical fields of study, and even if he or she must change curricula due to academic difficulties, the student is likely to opt for

another technical major (Chief of Naval Education and Training Interview, 1980). Thus, the 1200/650 requirement supports maintenance of a high mix of technical majors over the duration of each class' undergraduate study.

THE SUPPLY PROBLEM

The problem of ensuring an adequate supply of capable NROTC graduates is multifaceted, some elements of which are controllable, others of which are not. The most important uncontrollable factor is the decreasing population of entering college freshmen in America. As will be shown later, in 1977, the first year 80/20 was in effect, the entering college freshman population was approximately 2.4 million. Projections for 1980 fell to 1.9 million, and by 1984 the number is projected to drop to 1.6 million and remain relatively constant for several years. Slightly less than half of that number will be men, and men presently constitute approximately 95 percent of each NROTC class. The competition for quality undergraduates among colleges, universities, and industry will assuredly increase. Furthermore, the impact of the population trend is made more dramatic when one considers that less than one percent of high school seniors planning to attend college even mention military service as a career interest (Department of Defense Report, 1980).

Of those factors on which the Navy can have some influence, the one impacting most significantly on the supply of NROTC graduates is attrition during undergraduate studies. As

will be shown later, the vast majority of attrition occurs during the freshman and sophomore years, with the preponderence being voluntary. The timing is significant in that NROTC students do not incur a military obligation until they enter the junior year, after which dropping NROTC constitutes a breach of contract and may result in being ordered to active duty as an enlisted person. The obvious conclusion is that large numbers of scholarship holders enjoy the substantial benefits of the NROTC scholarship at one of the nation's leading academic institutions until just before being faced with obligated service, at which time, through original intent or otherwise, they voluntarily drop the program without consequence.

The 80/20 technical/nontechnical mix and 1200/650 SAT score requirements are also factors which impact on the supply of NROTC graduates. The question is, to what extent are they influential. Increased technological complexity has certainly not been restricted to military hardware. Is the Navy awarding 80 percent of its scholarships to persons for whom the pull of civilian industry is strongest? Is a person who is capable of achieving 1200/650--the 92nd percentile in 1977 (BDM Corporation, 1978)--such a rare commodity that he or she can take the NROTC Scholarship, enjoy the full tuition plus $100 per month allowance, and drop out of the program at the 2 year point, secure in the knowledge that he or she can obtain another scholarship and a high-paying

job upon graduation? Could retention, and thus the supply of graduates, be increased by altering the technical/nontechnical or SAT score mix? These questions and the implications for NROTC management policy that their answers may provide constitute the underlying theme of this thesis.

THE SUPPLY IN THE APPLICANT PHASE

A SUPPLY MODEL

The flow diagram of a model which was developed to analyze the supply of NROTC graduates is shown in Figure 1. The model begins with the population of all entering college freshmen in a given year. This population is decreased by an interest factor indicated by the percentage of the population submitting an application for the NROTC Program. It should be noted that recruiting of NROTC applicants is the responsibility of the Recruiting Command. There are no NROTC-dedicated recruiting personnel, but rather the 190 Officer Program officers assigned to recruiting districts are responsible for NROTC recruiting among their other duties. The NROTC recruiting effort is comprised primarily of advertising and direct mailing campaigns (BDM Corporation, 1978). The applicant population is reduced to a number of finalists by a single minimum SAT/ACT score operator, above which an applicant is declared a scholarship finalist. Having achieved finalist status as either a Principle, 'A', 'B' or 'C' Alternate, a candidate undergoes in-depth screening which includes evaluation of his or her academic record, extra curricular activities, vocational interest, and physical condition. Each finalist is also interviewed by a minimum of two commissioned officers for a subjective evaluation of officer potential (Navy Recruiting Manual, 1978). Two

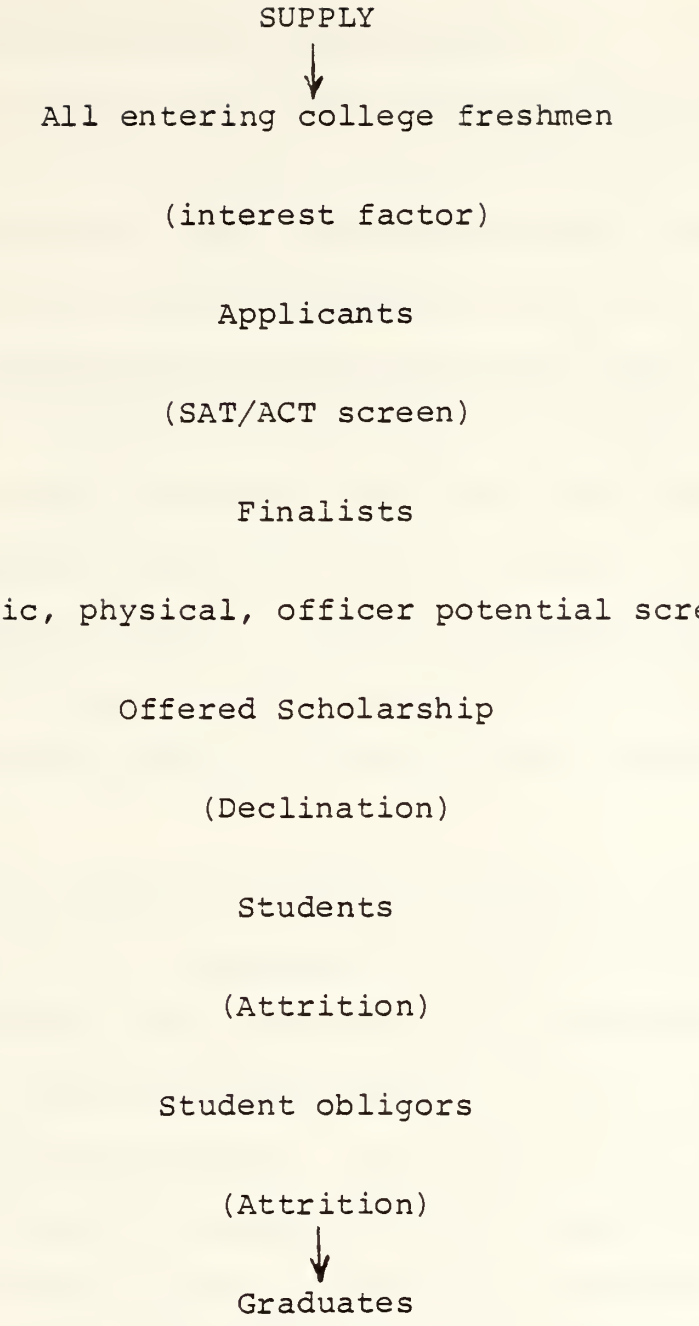

Figure 1. The Model of the Supply of NROTC Officers.

selection boards are then convened to select those candidates who will be offered scholarships.

The first board is the Early Selection Board which meets in November for the purpose of "selecting those finalists who are exceptionally well qualified and who possess the greatest potential, both academically and as career naval officers" (Precept for the Early Selection Board, 1978). The motivation behind an Early Selection Board is to make possible the early offering of an NROTC scholarship to obviously superior candidates who are likely to receive other scholarship offers. The Early Selection Board operates under the same functional guidelines as those to be delineated for the Central Selection Board, which meets in February.

The Central Selection Board is guided by a precept prepared annually by the Commander of the Naval Recruiting Command. This precept delineates selection standards including the technical education requirements of 80/20 as well as the 1200/650 SAT/ACT requirement. The Board is also reminded that the whole person concept should be maintained in the selection process. Academic potential, extracurricular activities, citizenship, work experience, and previous military record, if any, are all reviewed in order to gain an appreciation of the "whole person." These data, including intended college major, are contained in the file of each applicant. The Board then selects the number of candidates directed by

Commander, Naval Recruiting Command at the time the Board is convened (Precept for the Central Selection Board, 1977). This number is determined in a two-step process. First, the Chief of Naval Education and Training (CNET) determines the desired size of the entering class of freshmen based on the total number of scholarships allocated to the Navy. This number is set at 6,000 by Public Law 92-166. The portion of the 6,000 scholarships already allocated to students in the Program thus roughly determines the allowable size of the entering freshman class. Next, CNET employs historical data on the number of applicants annually declining scholarship offers to determine the safe number of selectees required to ensure that the available scholarships will be utilized (CNET Interview, 1980).

Returning to the model, those selected applicants who accept the scholarship then constitute the entering freshman class of NROTC midshipmen. As previously discussed, the attrition during the first two years reduces the supply of potential NROTC officers to the population of midshipmen entering the junior year, at which time service obligation is incurred. Attrition during the final two years of undergraduate study again reduces the size of the supply of officers until the survivors are graduated and commissioned.

THE SUPPLY MODEL AND THE CLASS OF 1981

This study deals extensively with Navy students (as opposed to Marine Corps students) in the NROTC Class of

1981 and to a lesser degree, the Class of 1982. Selection of these two cohorts was based on the fact that these are the first two classes selected under the 80/20 technical/non-technical mix requirement. The advantage of using the Classes of 1981 and 1982, other than the ability to observe 80/20 at work, was the fact that CNET, with the assistance of the Navy Personnel Research and Development Center, San Diego, recently began an effort to automate NROTC applicant and student data, a fact which allowed computer assistance in data collection and analysis. The disadvantage lies in the fact that neither of the Classes has graduated. While it does limit the scope of the analysis, tracking the students through their sophomore year is not felt to detract severely from the power of the analysis since the vast majority of attrition historically occurs during the first two years in the NROTC Program.

Figure 2 shows the effects of the operators contained in the previously introduced model when applied to the Class of 1981 which entered college in 1977. The population of applicants represents one percent of the population of freshmen entering college in 1977, a fact which validates the one percent interest factor previously discussed. Two operators were applied to the applicant population in 1977 in order to determine qualification as a scholarship finalist. White applicants were required to achieve a minimum SAT score of 1050 Composite with a 600 in mathematics, while minority applicants

SUPPLY

↓

All entering college freshmen--2,439,662

(Interest factor--1%)

Applicants--25,007

(SAT/ACT Screen--1050/600 and 950/520)

Finalists--9,077

(Screening--app 3,000 eliminated)

Offered Scholarships--3,088

(Declination--45%)

Students--1682

(Attrition--47%)

Student obligors--892

(Attrition--unk)

↓

Graduates

Figure 2. The Model Showing 1977 Data.

were required to achieve a minimum 950/520. This distinction was intended to increase minority representation; however, as a result of recent U.S. Supreme Court decisions the qualification score has since been changed to 950/520 for all applicants (Commander, Naval Recruiting Command Interview, 1980). Data analysis showed that of the 25,007 candidates applying for the Navy program, almost 7,000 were eliminated due to failure to submit SAT/ACT scores. Another 8,950 were classified as nonfinalists due to failure to meet the SAT/ACT minimum for selection as a finalist, resulting in 9,077 finalists. According to the 1977 Selection Board Precept, approximately 30 percent of the finalists were eliminated during pre-selection board screening due to physical disqualification, ineligibility, or failure to report. Of the approximately 6,000 finalists remaining, 4,276 were selected by the Boards. Of that number, 3,088 were offered scholarships. Approximately 45 percent of those offered, declined the scholarship, resulting in an entering class of 1682 Navy students. By the beginning of the junior year attrition had reduced the original population to 892 students.

The Class of 1981 Applicant Population

Table 2 profiles the population of entering college freshmen in 1977 as reported by the National Center for Educational Statistics (Digest of Education Statistics, 1979). The data presented in Table 3 were compiled by the College Entrance Examination Board from the almost one million,

TABLE 2

PROFILE OF 1977 COLLEGE BOUND HIGH SCHOOL SENIORS[a]

CATEGORY	MALE	FEMALE	TOTAL
Probable Field of Study (%)			
Technical[b]	28.4	5.7	16.7
Nontechnical	71.6	94.3	83.3
Took Scholastic Aptitude Test (%)	74.9	71.0	73.0

[a]Data based on a population of 2,439,662 students entering college in 1977.

[b]Includes majors falling under headings of "technical," "engineering," and "physical science."

TABLE 3

PROFILE OF 1977 SCHOLASTIC APTITUDE TEST EXAMINEES BY ETHNIC BACKGROUND, MAJOR, AND SAT ACHIEVEMENT

CATEGORY	MALE	FEMALE	TOTAL
Ethnic Background			
White (%)	84.9	82.9	83.9
Black (%)	7.2	10.1	8.8
[a]Other (%)	7.9	7.0	7.3
Respondents	390,762	428,462	819,224
Area of Intended Study			
[b]Technical (%)	26.6	5.9	15.8
Nontechnical (%)	73.4	94.1	84.2
Respondents	385,443	425,321	810,754
SAT Achievement			
Verbal mean	433	425	429
Mathematics mean	494	444	468
650 Mathematics (%)	13	4	8
Respondents	479,058	500,286	979,344

[a]Includes American Indian, Oriental, Puerto Rican, and Mexican-American.

[b]Includes Systems Analysis, Engineering, Mathematics, Military Science, and Physical Science.

college-bound, high school students who took the Scholastic Aptitude Test (SAT) and responded to a Student Descriptive Questionnaire (SDQ) in 1977. The data were reported to represent about two-thirds of all graduates who went directly to college in 1977 (National Report College-Bound Seniors, 1977). Comparing Tables 2 and 3, it can be seen that the percentages of students intending to enter technical and nontechnical fields of study are very close to the same and in directly opposite proportion to that sought by NROTC's 80/20 technical/nontechnical mix. Turning to the 1200/650 SAT requirement, statistics maintained by the Educational Testing Service do not include Composite score achievement, and thus it is not possible to calculate precisely the probability of achieving a 1200 Composite score conditioned on a 650 mathematics score. The data in Table 3 do show, however, that in 1977 the probability of a student's achieving 650 in mathematics was .08 (National Report, 1977) and that figure represents the highest possible probability of achieving a 1200 Composite given a 650 mathematics score. However, one can conclude intuitively that less than 100 percent of those students achieving a 650 mathematics score will also attain the verbal score of 550 required for a 1200 Composite score and the probability of a 1200/650 is thus in actuality something less than .08. In fact, as will be shown in Table 7, over 13 percent of the finalist population achieved a 650 mathematics score but less than a 550 verbal score. At any rate, it is obvious that achieving an annual input of NROTC

scholarship students who have achieved a 1200/650 SAT score profile requires a high degree of selectivity.

Tables 4 and 5 profile the applicant population prior to and after the finalist screen, respectively. As might be expected, whites and males dominate both the applicant and finalist populations. While black representation exceeds that of other minorities in the applicant population, blacks comprise a smaller percentage of the finalists. If blacks and other minorities are combined into a single minority category one can see that approximately 21 percent of minority applicants achieved finalist status (527/2480), while 38 percent of white applicants achieved finalist status (8550/22527). Thirty-six percent of all applicants met the finalist criteria. In terms of the original population of college bound seniors, finalists represent .4 percent of the population.

TABLE 4

CLASS OF 1981 APPLICANT POPULATION BEFORE FINALIST SCREENING (Percent of Total)

Ethnic Group	Male	Female	Total
White	19,853(79.4)	2,674(10.7)	22,527(90.1)
Black	1,210(4.8)	398(1.6)	1,608(6.4)
Other minority	741(3.0)	131(.5)	872(3.5)
All applicants	21,804(87.2)	3,203(12.8)	25,007(100)

TABLE 5

CLASS OF 1981
APPLICANT POPULATION
AFTER FINALIST SCREENING
(Percent of Total)

Ethnic Group	Male	Female	Total
	Finalists		
White	7,927(87.3)	623(6.9)	8,550(94.2)
Black	141(1.6)	22(.2)	163(1.8)
Other minority	328(3.6)	36(.4)	364(4.0)
All finalists	8,396(92.5)	681(7.5)	9,077(100)
	Nonfinalists		
White	7,107(79.4)	1101(12.3)	8,208(92.7)
Black	392(4.4)	108(1.2)	500(5.6)
Other minority	201(2.2)	44(.5)	245(2.7)
All nonfinalists	7,700(86.0)	1253(14.0)	8,953(100)
	No Test Scores		
White	4,819(69.1)	950(13.6)	5,769(82.7)
Black	677(9.7)	268(3.8)	945(13.5)
Other minority	212(3.0)	51(.8)	263(3.8)
All no test scores	5,708(81.8)	1269(18.2)	6,977(100)

The Class of 1981 Finalist Population

Before profiling those applicants who achieved finalist status, two groups of individuals bear mention, the "No Test Scores" group shown in Table 5 and the group of applicants who did not report for processing. Those 6,977 applicants who did not submit SAT/ACT scores were placed in the "No Test Scores" category and were eliminated from finalist consideration. If an applicant is not sufficiently interested in the NROTC Program to take the SAT or ACT and submit scores, it is difficult to conclude that he or she has a serious interest in NROTC. If a person falling in this category is then excluded from calculation of the interest factor indicated by the applicant population as a fraction of the population of entering college freshmen, the interest factor is lowered from one percent (25,007/2,439,662) to approximately .7 percent ((25007-6977)/2,439,662). Both this interest factor and the previously discussed finalist percentage will be significant to the analysis of data to be discussed later.

Those applicants who fail to report for processing were previously referred to as being included in the approximately 30 percent attrition occurring during finalist screening. Data analysis of the 1977 finalist population revealed that 1,999 finalist were in this category. As a result, the profile of finalists was reduced to 7,078. Table 6 profiles those finalists who failed to report for processing. It

TABLE 6

COMPOSITE SAT SCORES FOR
FINALISTS NOT REPORTING FOR PROCESSING

Sex and ethnic group	Mean	Std Dev	N
Male			
White	1235	104	1,738
Black	1110	106	32
Other	1154	123	84
Female			
White	1241	114	130
Black	1102	94	9
Other	1118	126	6
Overall	1229	109	1,999

was intended for this thesis to include a quantitative and qualitative profile of each subgroup in the finalist flow diagram illustrated in Figure 3.

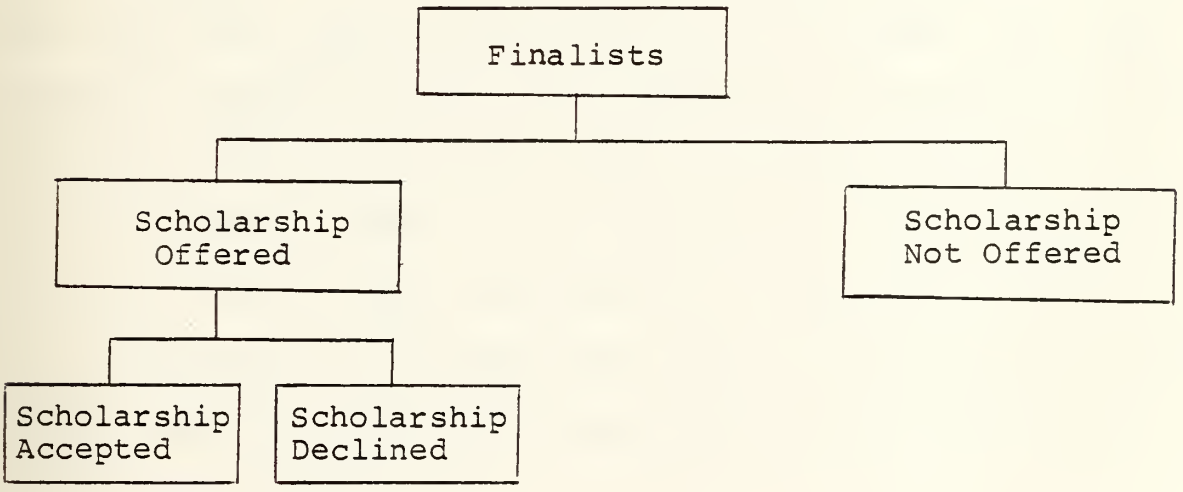

Figure 3. Flow Diagram from Finalist to College Enrollment.

Comparison of those accepting the scholarship with those declining was expected to be especially beneficial. Unfortunately, the automated data compiled on applicants for both the Classes of 1981 and 1982 did not contain the variables needed to identify these subgroups. As a result the profile includes all finalists without regard to selection status as a principle or alternate, or physical condition, each of which could have precluded a candidate's being offered a scholarship.

Table 7 illustrates the sex and racial profile of the finalists, the technical/nontechnical mix by race and sex, and the mean SAT Composite score by race/sex and technical/nontechnical mix. Table 8 illustrates the 1200/650 mix of the finalists. As can be seen the overall technical/nontechnical mix was 72/28, while the 1200/650 mix was 54/46. The Composite SAT score presented in Table 7 includes finalists who qualified via the ACT as well as by the SAT. This was possible because the data base included an SAT equivalent of the ACT composite score for those applicants who took the ACT. The math scores for those applicants taking the ACT were converted to SAT equivalents for inclusion in Table 8. This conversion was accomplished using the SAT/ACT Conversion Table employed by Naval Personnel Research and Development Center, San Diego.

Tables 9 and 10 profile the finalists according to a qualitative measure, the Overall Index of Academic and Officer Potential (OVI). The Overall Index is a composite of

TABLE 7

CLASS OF 1981
FINALIST COMPOSITE SAT SCORES

Sex and ethnic group	Technical			Nontechnical		
	Mean	Std Dev	N	Mean	Std Dev	N
Male						
White	1228	101	4,493	1224	98	1,696
Black	1106	112	79	1110	104	30
Other	1159	122	175	1126	104	69
Female						
White	1244	110	304	1226	94	189
Black	1101	112	8	1120	113	5
Other	1182	73	20	1151	116	0
Overall	1224	104	5,079	1219	101	1,999

TABLE 8

CLASS OF 1981
FINALIST 1200/650 MIX

Sex and ethnic group	Composite/Math Range			
	Above 1200/ Above 650	Above 1200/ Below 650	Below 1200/ Above 650	Below 1200/ Below 650
Male				
White	3,493	1,518	974	1,942
Black	12	21	9	99
Other	73	40	42	173
Female				
White	213	195	53	162
Black	3	1	0	18
Other	5	12	3	16
Total	3,799	1,787	1,081	2,410

TABLE 9

CLASS OF 1981
FINALIST OVERALL INDEX MIX,
INTENDED MAJOR TECHNICAL

Sex and ethnic group	OVI Value				
	1	2	3	4	5
Male					
White	1,735	1,231	745	482	300
Black	12	18	19	20	10
Other	53	42	36	26	18
Female					
White	124	98	49	24	9
Black	1	3	2	1	1
Other	9	7	3	1	0
Total	1,934	1,399	854	554	338

TABLE 10

CLASS OF 1981
FINALIST OVERALL INDEX MIX,
INTENDED MAJOR NONTECHNICAL

Sex and ethnic group	OVI Value				
	1	2	3	4	5
Male					
White	473	427	338	266	192
Black	5	6	2	7	10
Other	19	11	18	14	7
Female					
White	63	72	22	21	11
Black	1	2	0	0	2
Other	3	4	1	0	2
Total	564	522	381	308	224

two variables, Academic Composite Index (ACI) and Officer Potential Composite Index (OPCI). The ACI is a composite based on ratings of the applicant's high school record and SAT/ACT scores. The OPCI is a composite based on the results of the applicant's interview appraisals and the rating of his Strong Vocational Interest Blank and Background Questionnaire. The Overall Index is scaled from 1 to 5, 1 being the highest rating achievable (Navy Recruiting Manual, 1978). The 1977 Central Selection Board was advised that "Finalists whose overall group rating is '1' are initially considered to be the most desirable for the NROTC Scholarship. Conversely, those finalists in group rating '5' are considered to be the least desirable" (Precept for Central Selection Board, 1977). However the Board was also advised that, in keeping with the whole person concept, groupings according to OVI were not intended to limit the Board in any way.

THE SUPPLY IN THE STUDENT PHASE

As seen in the Supply Model, Figure 2, attrition during the first two years of the student phase reduced the NROTC Class of 1981 by 804 students. There is obviously cause for concern surrounding this attrition's impact on the supply of NROTC officers, but the deleterious impact of attrition is also felt in the addition to the dollar cost per commissionee resulting from the lost investment in attritees. As a prelude to an effort to identify factors contributing to attrition, this section profiles the entering students, the attritees, and the survivors to junior year. Various combinations of sex and ethnic group, college major, and quality will be utilized to illustrate the impact of attrition not only on the quantity of students, but also the effect of attrition on the pertinent mixes, both quantitative and qualitative. This section will also introduce the concept of the level of competitiveness found in the colleges sponsoring NROTC units. This variable was included in order to view attrition in terms of college quality as well as student quality.

CLASS OF 1981 ENTERING STUDENTS

The NROTC Class of 1981 consisted of 1,671 students holding Navy scholarships and 222 students holding Marine Corps scholarships. This study deals with the Navy scholarship

holders, less 26 students for whom data were missing from the data base.

College Level of Competitiveness

The level of competitiveness variable as derived for use in this study ranged from 1 to 4, with 1 being the highest level of competitiveness. The variable was derived using data from Barron's Profiles of American Colleges, 1977 which bases ratings of the competitiveness of colleges on median entrance examination scores (SAT mathematics and verbal averages, ACT composite), grade average, class standing, and the percentage of applicants admitted. Barron's rating scheme includes the following categories:

(1) Most Competitive (MC)--even superior students encounter a great deal of competition; high school class standing top 10% to 20%; A to B+ average; 650-800 SAT math and verbal, ACT above 28.

(2) Highly Competitive (HC)--high school class standing top 20-30%; B+ to B average; 600-650 SAT, 26-28 ACT.

(3) Very Competitive (VC)--top 30-50% of high school class; at least B- average; 550-600 SAT, 23-26 ACT.

(4) Competitive (C)--top 2/3 to 1/2 of high school class; some colleges require B- grade average, others require C+ or C; 450-550 SAT, 20-23 ACT.

(5) Less Competitive (LC)--top 75% of high school class; C grade average; below 500 SAT, below 20 ACT.

(6) Non Competitive (NC)--evidence of graduation from an accredicted high school.

A rating followed by a "+" indicates a higher level of competitiveness than other colleges in the category based on test scores and acceptance percentages (Barron's Profile of American Colleges, 1977 as reported in BDM Corporation, 1978). For the purposes of this study NROTC-sponsoring colleges rates as MC, HC+, and HC were calssified as competitiveness level 1; those rated as VC or VC+ were classified as level 2; colleges rated as C or C+ were classified as level 3; those rated as NC or LC were classified as level 4. Figure 4 lists colleges sponsoring NROTC units in 1977, their Barron's rating, and the level of competitiveness assigned in this study.

Profiles of Entering Students

Tables 11 and 12 profile the 1,645 Navy students for whom data existed by sex and ethnic group, college major, and the level of competitiveness of the college in which they enrolled. The data in Tables 11 and 12 reveal the following concerning the make-up of the Class of 1981:

(1) Male comprised 96% of the Class, females 4%.

(2) Majority representation was 95%, minority 5%, with blacks comprising 1.6% of the Class. There were no black females.

(3) Twenty-three percent of the Class enrolled in Level 1 colleges, 32% in Level 2, 40% in Level 3, 5% in Level 4 colleges.

(4) The technical/nontechnical percentage mix was approximately 77/23.

College	Rating	Level	College	Rating	Level
MIT	MC	1	Citadel	C	3
Rice	HC+	1	Colorado	C	3
RPI	HC+	1	Florida	C	3
Cornell	HC	1	Idaho	C	3
Duke	HC	1	Jacksonville	C	3
Northwestern	HC	1	Maine Mar.	C	3
Pennsylvania	HC	1	Marquette	C	3
Virginia	HC	1	Miami	C	3
Berkeley	VC+	2	Mississippi	C	3
Notre Dame	VC+	2	Missouri	C	3
Rochester	VC+	2	Oklahoma	C	3
Vanderbilt	VC+	2	Oregon State	C	3
Georgia Tech	VC	2	Penn State	C	3
Holy Cross	VC	2	Purdue	C	3
Illinois	VC	2	S. Carolina	C	3
Illinois Tech	VC	2	SUNY	C	3
Iowa State	VC	2	USC	C	3
Michigan	VC	2	Utah	C	3
N. Carolina	VC	2	Villanova	C	3
Tulane	VC	2	VMI	C	3
Washington	VC	2	Florida A&M	LC	4
Wisconsin	VC	2	New Mexico	LC	4
Minnesota	C+	3	Prairie View	LC	4
Texas	C+	3	Savannah St.	LC	4
Texas A&M	C+	3	Southern A&M	LC	4
Auburn	C	3	Kansas	NC	4
UCLA	C	3	Nebraska	NC	4
			Ohio State	NC	4

Figure 4. NROTC Colleges with Barron's Rating and Assigned Level of Competitiveness.

TABLE 11

PROFILE OF CLASS OF 1981 FRESHMEN
BY SEX, ETHNIC GROUP, AND COLLEGE COMPETITIVENESS[a]

Sex and ethnic group	College Level of Competitiveness				Total
	1	2	3	4	
Male					
White	340(20.7)	493(30.0)	587(35.7)	76(4.6)	1,496(91.0)
Black	3(.2)	10(.6)	10(.6)	4(.2)	27(1.6)
Other	14(.9)	10(.6)	27(1.6)	2(.1)	53(3.2)
Female					
White	17(1.0)	20(1.2)	28(1.7)	0(-)	65(3.9)
Black	0(-)	0(-)	0(-)	0(-)	0(-)
Other	0(-)	1(-)	3(.2)	0(-)	4(.2)
Total	374(22.8)	534(32.4)	655(39.8)	82(4.9)	1,645(100)

[a]Percent of total entrants in parenthesis. May not add to total due to rounding.

TABLE 12

PROFILE OF CLASS OF 1981 FRESHMEN
BY SEX, ETHNIC GROUP, COLLEGE COMPETITIVENESS, AND MAJOR[a]

Sex and ethnic group	College Competitiveness				Total
	Technical Majors				
	1	2	3	4	
Male					
White	264(16.0)	394(24.0)	441(26.8)	64(3.9)	1,163(70.7)
Black	2(.1)	7(.4)	6(.4)	3(.2)	18(1.1)
Other	13(.8)	8(.5)	17(1.0)	1(-)	39(2.4)
Female					
White	14(.9)	14(.9)	21(1.3)	0(-)	49(3.0)
Black	0(-)	0(-)	0(-)	0(-)	0(-)
Other	0(-)	0(-)	2(.1)	0(-)	2(.1)
Total	293(17.8)	423(25.8)	487(29.6)	68(4.1)	1,271(77.3)
	Nontechnical Majors				
Male					
White	76(4.6)	99(6.0)	146(8.9)	12(.8)	333(20.3)
Black	1(-)	3(.2)	4(.2)	1(-)	9(.5)
Other	1(-)	2(.1)	10(.6)	1(-)	14(.9)
Female					
White	3(.2)	6(.4)	7(.4)	0(-)	16(1.0)
Black	0(-)	0(-)	0(-)	0(-)	0(-)
Other	0(-)	1(-)	1(-)	0(-)	2(.1)
Total	81(4.9)	111(6.7)	168(10.2)	14(.9)	374(22.7)

[a]Percent of total entrants in parenthesis. May not add to total due to rounding.

The profile of mean Composite SAT and Overall Index scores of all entering freshmen by race, sex, and major are given in Table 13.

The composite scores of those entering freshmen who achieved the criterion of a 1200/650 SAT Composite/Mathematics score are presented in Table 14 by sex, ethnic group, and major. The figure of 889 total students derived from automated data processing indicates that the mix of 1200/650 students was approximately 55/45 which is well short of the 80/20 goal for SAT scores. Raw data files maintained by CNET indicate the entering mix was actually 63/38. The author was unable to resolve this difference; however, assuming that the data base was accurately compiled in the transition to automated data format, a likely contributor to the discrepancy is in the conversion of ACT mathematics scores to SAT equivalents, since none of the other scores required manipulation by computer programming. The fact remains however that the Navy's goal of 80 percent 1200/650 SAT scores was not achieved. Of the students represented in Table 14, 33 percent enrolled in colleges in competitiveness level 1, 32 percent enrolled in level 2 colleges, 32 percent in level 3 colleges, and 3 percent in level 4 colleges.

The tabular data presented thus far is intended to allow the reader to evaluate the NROTC Class of 1981 in terms of the Navy's two 80/20 requirements, as well as sense the general flavor of the Class in terms of its composition and

TABLE 13

SAT COMPOSITE AND OVERALL INDEX SCORES OF CLASS OF 1981 FRESHMEN BY MAJOR, SEX, AND ETHNIC GROUP

Sex and ethnic group	SAT Composite[a]		Overall Index[b]		N
	Mean	Std Dev.	Mean	Std. Dev.	
Technical Majors					
Male					
White	1253	96	1.67	.91	1,163
Black	1051	87	3.33	1.24	18
Other	1191	137	1.87	1.00	39
Female					
White	1284	109	1.59	.84	49
Other	1250	42	1.00	0	2
Overall	1249	102	1.69	.94	1,271
Nontechnical Majors					
Male					
White	1250	95	1.81	.97	333
Black	1067	94	3.56	1.59	9
Other	1127	82	2.07	1.00	14
Female					
White	1289	112	2.00	.89	16
Other	1250	71	2.00	0	2
Overall	1249	102	1.87	1.02	374

[a]For the total population of 1,645 entrants, the SAT Composite mean was 1248 with a standard deviation of 102.

[b]Total population OVI mean was 1.73 with a standard deviation of .96.

TABLE 14

COMPOSITE SAT SCORES OF 1200/650 STUDENTS
BY SEX, ETHNIC GROUP, AND MAJOR

Sex and ethnic group	Major					
	Technical			Nontechnical		
	Mean	Std. Dev.	N	Mean	Std. Dev.	N
Male						
White	1307	72	654	1303	78	181
Other	1318	100	14	-	-	-
Female						
White	1342	100	27	1343	91	11
Other	1220	0	1	1200	0	1
Overall	1308.4	76	696	1304.4	80	193

academic quality. It should be clear that while desiring an even higher quality in terms of college entrance examination scores than was achieved, the Navy was successful in assembling an extremely high quality of input to the NROTC in 1977.

ATTRITEES DURING FRESHMAN AND SOPHOMORE YEARS

Attrition decreased the original NROTC Class of 1981 by 279 scholarship holders during the freshman year and 525 scholarship holders during the sophomore year, equating to an attrition rate of 48 percent after two years. Tables 15, 16, and 17 profile the attritees in total, by year of attrition and by college major. Tables 18 and 19 profile attritees by SAT composite scores and Overall Index scores. Individual data for nine students who attrited during the freshman year and six students who attrited during the sophomore year were missing from the data base and as a result these students are not included in the profile of attritees presented in this section. The data presented in Tables 11, 14, 15 and 16 can be summarized to indicate the following concerning attrition during the first two years of the course of instruction for the Class of 1981:

(1) Attrition by race/sex closely approximated the entering population percentage, e.g., 90% of the original entrants were white males, and 90% of all attritees were white males.

(2) Forty-eight percent of the original male entrants attrited. Thirty-nine percent of the original female entrants attrited.

TABLE 15

FREQUENCY AND RELATIVE FREQUENCY[a] OF ALL FRESHMAN AND SOPHOMORE YEAR ATTRITEES BY SEX, ETHNIC GROUP, AND COLLEGE COMPETITIVENESS

Sex and ethnic group	College Level of Competitiveness												Total	P(E)	P(A)
	1			2			3			4					
	N	P(E)	P(A)	N	P(E)	P(A)	N	P(E)	P(A)	N	P(E)	P(A)			
Male															
White	165	48.5	21.0	234	47.5	29.7	283	48.2	35.9	44	57.9	92.0	726	48.5	92
Black	2	66.7	.3	6	60.0	.8	3	30.0	.4	1	25.0	.1	12	44.4	1.6
Other	9	64.3	1.1	3	30.0	.4	10	37.0	1.3	2	100	.3	24	45.3	3.1
Female															
White	7	41.2	.9	9	45.0	1.1	10	35.7	1.3	0	-	-	26	40.0	3.3
Other	0	-	-	0	-	-	1	33.3	.1	0	-	-	1	25.0	.1
Total	183	48.9	23.2	252	47.2	32.0	307	46.9	39.0	47	57.3	6.0	789	48.0	100

[a] P(E)--N as a relative frequency (percent) of total entering freshmen in the cell (Table 11). May not add to total due to rounding

P(A)--N as a realtive frequency (percent) of all attrittees. May not add to total due to rounding.

TABLE 16

PROFILE OF FRESHMAN AND SOPHOMORE YEAR ATTRITEES IN TECHNICAL MAJORS BY SEX, ETHNIC GROUP, COLLEGE COMPETITIVENESS, AND YEAR IN SCHOOL[a]

Sex and ethnic group	College Level of Competitiveness				Total
	1	2	3	4	
Freshman Year					
Male					
White	26(3.3)	77(9.8)	68(8.6)	13(1.6)	184(23.3)
Black	0(-)	1(.1)	1(.1)	0(-)	2(.3)
Other	5(.6)	2(.3)	4(.5)	1(.1)	12(1.5)
Female					
White	3(.4)	3(.4)	5(.6)	0(-)	11(1.4)
Other	0(-)	0(-)	0(-)	0(-)	0(-)
Total	34(4.3)	83(10.6)	78(9.9)	14(1.7)	209(26.5)
Sophomore Year					
Male					
White	102(13.0)	113(14.3)	139(17.6)	24(3.1)	378(48.0)
Black	1(.1)	3(.4)	1(.1)	0(-)	5(.6)
Other	3(.4)	1(.1)	4(.5)	0(-)	8(1.0)
Female					
White	3(.4)	4(.5)	3(.4)	0(-)	10(1.3)
Other	0(-)	0(-)	0(-)	0(-)	0(-)
Total	109(13.9)	121(15.3)	147(18.6)	24(3.1)	401(50.9)

[a]Percent of all attritees in parenthesis. May not add to total due to rounding.

TABLE 17

PROFILE OF FRESHMAN AND SOPHOMORE YEAR ATTRITEES IN NONTECHNICAL MAJORS BY SEX, ETHNIC GROUP, COLLEGE COMPETITIVENESS AND YEAR IN SCHOOL[a]

Sex and ethnic group	College Level of Competitiveness				Total
	1	2	3	4	
Freshman Year					
Male					
White	8(1.0)	13(1.6)	34(4.3)	2(.3)	57(7.2)
Black	1(.1)	0(-)	1(.1)	0(-)	2(.3)
Other	0(-)	0(-)	0(-)	0(-)	0(-)
Female					
White	1(.1)	1(.1)	0(-)	0(-)	2(.3)
Other	0(-)	0(-)	0(-)	0(-)	0(-)
Total	10(1.3)	14(1.7)	35(4.4)	2(.3)	61(7.8)
Sophomore Year					
Male					
White	29(3.7)	31(3.9)	42(5.3)	5(.6)	107(13.6)
Black	0(-)	2(.3)	0(-)	1(.1)	3(.4)
Other	1(.1)	0(-)	2(.3)	1(.1)	4(.5)
Female					
White	0(-)	1(.1)	2(.3)	0(-)	3(.4)
Other	0(-)	0(-)	1(.1)	0(-)	1(.1)
Total	30(3.8)	34(4.3)	47(6.0)	7(.8)	118(15.0)

[a]Percent of all attritees in parenthesis. May not add to total due to rounding.

TABLE 18

SAT COMPOSITE SCORES
OF CLASS OF 1981 ATTRITEES[a]

Sex and ethnic group	Major					
	Technical			Nontechnical		
	Mean	Std Dev	N	Mean	Std Dev	N
Freshman Year						
Male						
White	1249	89	184	1254	104	57
Black	975	7	2	1100	28	2
Other	1169	104	12	-	-	-
Female						
White	1287	116	11	1355	78	2
Overall	1243	96	209	1252	107	61
Sophomore Year						
Male						
White	1259	96	378	1256	97	107
Black	1106	118	5	1063	110	3
Other	1224	120	8	1145	64	4
Female						
White	1282	102	10	1233	118	3
Other	-	-	-	1200	0	1
Overall	1257	99	401	1247	102	118

[a]For the total population of 789 attritees, the SAT Composite mean was 1255 with a standard deviation of 99.

TABLE 19

OVERALL INDEX SCORES OF CLASS OF 1981 ATTRITEES[a]

Sex and ethnic group	Curriculum					
	Technical			Nontechnical		
	Mean	Std Dev	N	Mean	Std Dev	N
Freshman Year						
Male						
White	1.79	.98	184	1.96	1.02	57
Black	4.50	.71	2	3.00	1.41	2
Other	2.42	1.31	12	-	-	-
Female						
White	1.82	.87	11	1.50	.71	2
Overall	1.85	1.03	209	1.98	1.02	61
Sophomore Year						
Male						
White	1.62	.90	378	1.84	1.05	107
Black	3.60	.55	5	5.00	0	3
Other	1.75	.71	8	2.25	.96	4
Female						
White	1.50	.52	10	1.67	.58	3
Other	-	-	-	2.00	0	1
Overall	1.64	.91	401	1.93	1.13	118

[a]For the total population of 789 attritees, the Overall Index mean was 1.71 with a standard deviation of .97.

(3) Of the original entering population, freshman year attrition was 16.4 percent compared to 31.5 percent during the sophomore year.

(4) Forty-eight percent of the original technical majors attrited, as did 48% of the nontechnical majors. Seventy-six percent of all attritees were technical majors while twenty-four percent were nontechnical majors.

(5) Of the students originally enrolled in Level 1 colleges, 49% attrited; Level 2, 47%; Level 3, 47%; Level 4, 57%.

In order to further evaluate who was leaving the NROTC program, the student population was categorized by ranges of SAT Composite score, e.g., above 1300, 1250-1300, etc. Analysis on this basis revealed that 87 percent of those students with an SAT Composite above 1300 disenrolled (266/305). Forty-eight percent of those between 1250 and 1300 disenrolled (107/223), as did 50 percent of those with an SAT Composite above 1200. The only category which demonstrated a survival rate markedly greater than 50 percent was that of students possessing an SAT Composite between 1150 and 1200. Only 38 percent of these students attrited.

Having shown who dropped out of the NROTC Program, Table 20 lists the reasons for attrition for those 797 attritees on whom data was available. The reasons listed were those given by the students upon disenrollment from the program. Reasons from "Unable to adapt" down to and including "Physical" represent voluntary disenrollment, while the remainder represent involuntary disenrollment, other than transfer to the Naval Academy or Naval Academy Preparatory School. The data

TABLE 20

CLASS OF 1981 REASONS FOR ATTRITION[a]

Reason	Year Attrited		
	Freshman	Sophomore	Total
Unable to adapt	52(6.5)	64(8.0)	116(14.5)
Dislike for travel	2(.3)	2(.3)	4(.5)
Dislike for cruise	1(.1)	14(1.8)	15(1.9)
Dislike for military	50(6.3)	86(10.8)	136(17.1)
Enter other profession	78(9.8)	207(26.0)	285(35.8)
Financial	9(1.1)	9(1.1)	18(2.2)
Personal	42(5.3)	93(11.7)	135(17.0)
Physical	2(.3)	15(1.9)	17(2.1)
Academic discharge	4(.5)	10(1.3)	14(1.8)
Disciplinary	4(.5)	1(.1)	5(.6)
Dropped institution	18(2.3)	14(1.8)	32(4.0)
Unsuitable	2(.3)	4(.5)	6(.8)
Transfer to USNA	7(.9)	0(-)	7(.9)
Transfer to NAPS	1(.1)	0(-)	1(.1)
Inaptitude	0(-)	5(.6)	5(.6)
Conscientious objection	0(-)	1(.1)	1(.1)
No reason	0(-)	0(-)	0(-)
Total	272(34.1)	525(65.9)	797(100)

[a]Percent of all attritees in parenthesis. May not add to total due to rounding.

in Table 20 reveal the following concerning attrition in the Class of 1981:

(1) Ninety-one percent of the attrition was voluntary, 9 percent involuntary.

(2) Combining "Dislike for military" and "Enter other profession," 53 percent of attrition was due to a career choice other than the Navy. Further analysis showed that 35% of students leaving for this reason possessed an SAT Composite above 1300.

(3) Voluntary disenrollment during the freshman year amounted to 29.6 percent of the two-year total attrition, while sophomore year voluntary disenrollment more than doubled as a percent of the two-year total, to 61.6 percent.

Observing that the attrition rate during sophomore year seemed to support the previously discussed DoD concern that many students were taking advantage of the NROTC scholarship and then voluntarily disenrolling rather than incur a military obligation, sophomore year attrition was analyzed on a monthly basis. The results showed that 43 percent of total attrition occurred between April of the sophomore year and the beginning of the junior year when the military obligation is incurred. Sixty percent of the attrition occurring during the late-sophomore year was for reasons reflecting a career choice other than the Navy.

CLASS OF 1981 MILITARY OBLIGORS

Tables 21, 22, 23 profile those students who survived to the junior year and incurred a military obligation. As can be seen by comparing the profiles of the entering freshman, attritees, and military obligors, attrition reduced the

TABLE 21

PROFILE OF CLASS OF 1981 MILITARY OBLIGORS BY SEX, ETHNIC GROUP, AND COLLEGE COMPETITIVENESS

Sex and ethnic group	College Level of Competitiveness				
	1	2	3	4	Total
Male					
White	175(10.6)	259(15.7)	304(18.5)	32(1.9)	770(46.8)
Black	1(.1)	4(.2)	7(.4)	3(.2)	15(.9)
Other	5(.3)	7(.4)	17(1.0)	0(-)	29(1.7)
Female					
White	10(.6)	11(.7)	18(1.1)	0(-)	39(2.4)
Other	0(-)	1(.1)	2(.1)	0(-)	3(.2)
Total	191(11.6)	282(17.1)	348(21.1)	35(2.1)	856(52.0)

[a]Percent of total original entrants (Table 11) in parenthesis. May not add to total due to rounding.

TABLE 22

PROFILE OF CLASS OF 1981 MILITARY OBLIGORS BY SEX, ETHNIC GROUP, COLLEGE COMPETITIVENESS, AND MAJOR[a]

Sex and ethnic group	College Level of Competitiveness				Total
	1	2	3	4	
Technical Majors					
Male					
White	136(51.5)	204(51.8)	234(53.1)	27(42.2)	601(51.7)
Black	1(50.0)	3(42.9)	4(66.7)	3(100)	11(61.1)
Other	5(38.5)	5(62.5)	9(52.9)	0(-)	19(48.7)
Female					
White	8(57.1)	7(50.0)	13(61.9)	0(-)	28(57.1)
Other	0(-)	0(-)	2(100)	0(-)	2(100)
Total	150(51.2)	219(51.8)	262(53.8)	30(44.1)	661(52.0)
Nontechnical Majors					
Male					
White	39(51.3)	55(55.5)	70(47.9)	5(41.7)	169(50.8)
Black	0(-)	1(33.3)	3(75.0)	0(-)	4(44.4)
Other	0(-)	2(100)	8(80.0)	0(-)	10(71.4)
Female					
White	2(66.7)	4(66.7)	5(71.4)	0(-)	11(68.8)
Other	0(-)	1(100)	0(-)	0(-)	1(50.0)
Total	41(50.6)	63(56.8)	86(51.2)	5(35.7)	195(52.1)

[a]Percent of total entering freshmen in the cell (Table 12) in parenthesis. May not add to total due to rounding.

TABLE 23

SAT COMPOSITE AND OVERALL INDEX SCORES OF CLASS OF 1981 MILITARY OBLIGORS BY MAJOR, SEX, AND ETHNIC BACKGROUND

Sex and ethnic group	SAT Composite[a]		Overall Index[b]		N
	Mean	Std Dev	Mean	Std Dev	
Technical Majors					
Male					
White	1250	99	1.67	.89	601
Black	1040	67	3.00	1.41	11
Other	1191	163	1.58	.77	19
Female					
White	1284	113	1.54	.92	28
Other	1250	42	1.00	0	2
Overall	1245	105	1.67	.92	661
Nontechnical Majors					
Male					
White	1246	91	1.74	.91	169
Black	1055	119	2.75	1.71	4
Other	1120	90	2.00	1.05	10
Female					
White	1293	117	2.18	.98	11
Other	1300	0	2.00	0	1
Overall	1239	101	1.80	.95	195

[a]For the entire population of 856, the mean SAT Composite was 1244 with a standard deviation of 104.

[b]For the entire population, the mean OVI was 1.71 with a standard deviation of .92.

overall quality of the Class of 1981 in terms of SAT achievement. The technical/nontechnical mix remained relatively constant at 77/23.

It must be pointed out that the population of military obligors does not represent the total of those students who will comprise the Class of 1981 at graduation. Attrition has and will continue to occur, although at a much slower rate than during the freshman and sophomore years. Also, two- and one-year scholarship students will be added to the Class to replace a portion of those who have attrited. It was intended that this study include a profile of those scholarship students added during the junior and senior years in order to compare the relative qualities of attritees and addees, and to evaluate the net impact on the technical/nontechnical mix as well as the mix of 1200/650 SAT score achievers. Unfortunately, data on two- and one-year scholarship holders is neither automated nor centralized. Complicating any potential analysis is the fact that selection of two- and one-year scholarship students is in many areas more subjective than with four-year scholarship students and few commonalities exist upon which to base a comparison.

IDENTIFICATION OF FACTORS CONTRIBUTING TO ATTRITION DURING THE STUDENT PHASE

The objective of the analysis discussed in this section is to attempt to identify those factors which contributed to attrition in the NROTC Class of 1981. The underlying motivation was to investigate what impact the Navy's policies governing the mix of student input, specifically the college major mix and SAT score mix, was having on the supply of NROTC officers during the student phase. The statistical methods employed in identifying factors contributing to attrition were discriminant analysis, multiple regression analysis, and multivariate contingency table analysis. The variables used in the analyses are listed in Figure 5. These variables were selected because they were consistent with the theme of this study and were available for all students. The data base also included Strong Vocational Interest Blank and Background Questionnaire items which offered additional potential for predicting NROTC attrition, but they were not consistent with the intent of this study. Research dealing exclusively with NROTC attrition prediction is presently on-going at the Navy Personnel Research and Development Center in San Diego.

ANALYSIS OF ATTRITION ON AN INDIVIDUAL CASE BASIS

Analysis of NROTC attrition was first undertaken dealing with individual cases using the variables listed in Figure 5.

Variable	Description
	Independent Variables
ST1	white
ST2	black male
ST3	other male
ST4	white female
ST5	other female
M1	technical major
M2	nontechnical major
C1	college level of competitiveness 1
C2	college level of competitiveness 2
C3	college level of competitiveness 3
C4	college level of competitiveness 4
MD1	military dependent
ES1	selected by Early Board
SL1	composite SAT, above 1300
SL2	composite SAT, 1250-1299
SL3	composite SAT, 1200-1249
SL4	composite SAT, 1150-1199
SL5	composite SAT, 1100-1149
SL6	composite SAT, below 1100
R1	dropped program for choice of career other than Navy
R2	dropped program for reason other than alternate career choice
OVI	Overall Index scoe

Figure 5. Variables Included in the Analysis of Attrition.

Figure 5 (CONTINUED)

Variable	Description
	Dependent Variables
DROPF	dropped program during freshman year
DROPS	dropped program during sophomore year
SURV	survived to junior year

Establishing a Relationship Between Attrition and the Variables

Preliminary to more detailed analysis, Pearson correlations were computed for the variables listed in Figure 5 using the Pearson Correlation function in the Statistical Package for the Social Sciences (Nie, et al., 1975). This function measures the strength of relationship between two variables and the statistical significance level of the relationship. The correlation between the dependent and independent variables is shown in Table 24.

Since the data already presented concerning the attrition rates by college major showed that students with technical majors and students with nontechnical majors attrited in percentages equal to total attrition, no strongly differentiating relationship was felt to exist between NROTC attrition and college major. As a result, the initial analysis effort focused on investigating the relationship between attrition and SAT composite score. To establish the existence of such a relationship, the contingency table shown in Table 25 was compiled for the Class of 1981 and was analyzed using the log-linear model for multi-way frequency tables contained in the Biomedical Computer Programs P-Series (Dixon & Brown, 1979). Black males and females other than white were not included due to the large number of cell frequencies having a value of zero for these students. The results of the computer analysis confirmed a nearly significant two-factor interaction between composite SAT score and sex/ethnic group,

TABLE 24

CORRELATION BETWEEN DEPENDENT AND INDEPENDENT VARIABLES

Independent Variables	Dependent Variables		
	DROPF	DROPS	SURV
ST1	-.029(.115)	.064(.004)	-.038(.062)
ST2	.004(.434)	-.008(.372)	.004(.429)
ST3	.033(.092)	-.040(.051)	.013(.299)
ST4	.016(.253)	-.057(.018)	.035(.074)
M1	-.012(.311)	.005(.418)	.004(.430)
C1	-.069(.002)	.066(.003)	-.010(.336)
C2	.031(.103)	-.034(.082)	.009(.363)
C3	.022(.182)	-.037(.064)	.018(.232)
MD1	.007(.384)	-.018(.224)	.011(.320)
SL1	-.031(.100)	.034(.081)	-.008(.366)
SL2	.022(.184)	.009(.352)	-.025(.152)
SL3	.047(.027)	.007(.396)	-.041(.046)
SL4	-.056(.011)	-.023(.172)	.064(.005)
SL5	.003(.450)	-.020(.208)	.016(.254)
SL6	.009(.363)	-.039(.057)	.030(.114)
R1	.213(0.0)	.477(0.0)	-.603(0.0)
R2	.372(0.0)	.681(0.0)	-.910(0.0)
OVI	.052(.017)	-.015(.269)	-.025(.154)

TABLE 25

CONTINGENCY TABLE

Category	Sex and ethnic group	SAT Composite				
		Above 1300	1250-1299	1200-1249	1150-1199	1100-1149
Attrited						
	White males	251	166	160	49	79
	Other males	4	4	4	3	6
	White females	11	3	7	4	1
Survived						
	White males	258	157	144	88	92
	Other males	5	3	4	3	7
	White females	16	9	7	2	5

and a statistically significant interaction between SAT composite and Drop/Survive, based on chi-square values of 14.55 ($p = .07$) and 10.75 ($p = .03$), respectively. The two-factor interaction between sex/ethnic group and Drop/ Survive was insignificant, based on a chi-square value of 2.05 ($p = .358$).

In an analysis involving multivariate contingency tables each contingency table is independent of the other, and since evaluation of the simultaneous effects of the variables is thus limited, another analytical function was called for at this point. In analyzing attrition on an individual-case basis, the dependent variable is a dichotomy in that the individual either attrites or does not attrite. Thus discriminant analysis was the appropriate function for detailed analysis of attrition on an individual-case basis.

Discriminant Analysis of Attrition

Discriminant analysis allows the researcher to statistically distinguish between two or more groups of cases (Nie, et al., 1975). After selecting the groups with which he intends to deal, the researcher selects variables that measure characteristics on which the groups are expected to differ. The degree to which one can predict into which group an individual will fall if the discriminating variables are known for the individual is then determined. The prediction capability depends on the strength of the relationship between the dependent variable and the independent discriminating variables.

Five separate levels of discriminant analysis were performed using student cases from the NROTC Class of 1981. The first analysis dealt with the entire class and attempted to discriminate between the group of attritees and the group of survivors. The second analysis also attempted to discriminate between the group of attritees and the group of survivors but dealt only with the population of students having a SAT Composite score above 1200. The third analysis dealt with the population of attritees and attempted to discriminate between the group of freshman year attritees and the group of sophomore year attritees. The fourth analysis also dealt with the population of attritees, but in this case attempted to discriminate between the group of students who stated "Dislike for Military" or "Enter Other Profession" as the reason for attriting (see Table 20) and the group of students who attrited for all other reasons. The final analysis dealt with the population of attritees having a SAT Composite score above 1200 and attempted to discriminate between the groups used in the fourth analysis.

The variables used to distinguish students were the same in all 4 analyses: Composite SAT score, OVI (1-5), and College Level of Competitiveness (1-4) were entered as continuous variables, and ST1, ST2, ST3, ST4, ST5, and M1 were entered as dummy variables. The minimum tolerance level for inclusion of a variable in the discriminant function was .001 which resulted in the inclusion of all variables except ST5

at all levels of analysis. The results of the analyses are shown in Table 26 and reveal that the indepenedent variables used in the analyses have poor discriminating potential.

The third analysis showed that the greatest predictive capability resulted when discriminating between freshman year attritees and sophomore year attritees, and bears mention. Table 27 lists the discriminant function coefficients for those variables meeting the .001 tolerance level. The coefficients represent the relative contribution of the variable to the discriminant function. The sign denotes whether the variable is making a positive or negative contribution (Nie, et al., 1975). As can be seen in Table 27, the sex/ethnic background variables make the greatest contribution to the function, while SAT composite score and college major make the least contribution. The canonical correlation for this function was .1463, which, when squared, indicates that 2 percent of the variance in the discriminant function was explained by the groups (Nie, et al., 1975). Although this value may be too low for practical significance, it is reliable and indicates that there is a difference between freshman and sophomore attritees. Analyses 1, 2, 4, and 5 show only a slightly greater than 50 percent chance of predicting into which group an individual will fall, and the futility of further analysis on an individual-case basis using the variables of interest in this study is apparent.

TABLE 26

DISCRIMINANT ANALYSIS OF THE ENTIRE GROUP AND SUBGROUPS OF STUDENTS FOR PREDICTING SURVIVAL OR ATTRITION

Analysis[a]	Prediction Capability	Chi-sq	df	Significance
1	50.81%	8.03	8	.3300
2	51.99%	7.59	8	.4741
3	58.10%	17.21	8	.0280
4	52.34%	5.67	8	.6836
5	50.25%	2.77	8	.9477

[a]Analysis 1 - for the entire class, predict survive or attrite

Analysis 2 - for students with SAT Composite above 1200, predict attrite or survive

Analysis 3 - for attritees, predict freshman year attrition or sophomore year attrition

Analysis 4 - for attritees, predict attrition because of alternate career choice or attrition for a reason other than an alternate career choice

Analysis 5 - for attritees with SAT Composite above 1200, predict attrition because of alternate career choice of attrition for a reason other than an alternate career choice

TABLE 27

DISCRIMINANT FUNCTION FOR PREDICTING
FRESHMAN YEAR OR SOPHOMORE YEAR ATTRITION

Variable	Coefficient
white male	1.59535
white female	1.49171
other male	1.45354
black male	0.69950
college level of competitiveness	0.57364
overall index	0.41199
college major	-0.23342
composite SAT score	-0.06745

ANALYSIS OF ATTRITION WITH THE COLLEGE AS THE UNIT OF ANALYSIS

Given the failure of the variables to predict on an individual-case basis, it was decided to aggregate data for each NROTC-sponsoring college to examine whether the aggregation of the variables describing the NROTC student population at each college would result in a meaningful analysis. In order to have a continuous, rather than categorical, dependent variable, the probability of survival to junior year for each NROTC-sponsoring college was chosen as the dependent variable.

Multiple Regression Analysis of Attrition

Multiple regression analysis was selected as the appropriate function for the analysis. The dependent variable was the proportion of entering students surviving to the junior year; however, to avoid using a dichotomous dependent variable, a logit transformation of the dependent variable was utilized (Johnston, 1963), resulting in:

$$\ln \frac{P_i}{1 - P_i} = a + \sum_{j=1}^{k} B_j X_{ij} + Z_i$$

where ln is the natural logarithm, P_i is the proportion surviving to the junior year, a is an intercept that subsumes one dummy variable of each set, B_i's represent the coefficients to be estimated, X_i's are the independent variables and Z_i is the error term.

The independent variables used in the analysis included both continuous and categorical variables. The Composite

SAT Score, Overall Index, and College Level of Competitiveness were continuous variables; M1, ST1, ST4, MD1, and ES1 were categorical variables (see Figure 5 for variable definitions). All of the variables were divided by the number of students enrolled at each college so that the continuous variables were converted to their mean value and the categorical variables were converted to a proportion of the population at each school. In order to increase the data base for this analysis both the Classes of 1981 and 1982 were utilized, and a dummy variable for Year was included, 1981 having a value of 1. The reference group subsumed in the a term of the regression equation included the Class of 1982, males other than white and females other than white who were not early selectees, not military dependents, and those whose major was nontechnical.

Weighted step-wise, multiple regression was run using the logit equation. Because the number of NROTC students varied among the colleges, it was necessary to weight each case (college) in the regression analysis. Weighting ensured that equitable significance was given to the probability of survival at large colleges compared to small colleges, in effect artificially holding the size of the NROTC student population constant. The weight factor was $\sqrt{npq}$, where n is the number of students at each college, p is the proportion of students surviving to the junior year, and q is the proportion of students attriting before the junior year. Where

$p_i = 1$, the survival rate was computed as $1 - (\frac{1}{2}n)$ (Lockman, 1976). Variables were no longer added to the equation when the significance level for entering the equation dropped below .05.

Results of Multiple Regression Analysis

Table 28 shows the intercorrelation matrix of the variables used in the analysis. The results of the analysis are shown in Table 29 and reveal that the Overall Index, Early Selection, and Composite SAT score correlated positively with survival, while the College Level of Competitiveness and White Male variables were negatively correlated with survival. Although the Composite SAT score had a low level of significance in the regression, the variable was included in the equation because it provided a better fit of the equation to the data by enhancing the contribution of the other variables to the prediction of survival. In terms of the variables:

(1) As the mean value of the Level of Competitiveness variable at a college increases (equating to an actual decrease in competition), the probability of survival decreases.

(2) As the mean value of the Overall Index variable among NROTC students at a college increases (equating to a decrease in the quality of the student) the probability of survival increases.

(3) As the proportion of early selectees among NROTC students at a college increases, the probability of survival increases.

(4) As the proportion of white males among NROTC students at a college increases, the probability of survival decreases.

TABLE 28

INTERCORRELATION MATRIX FOR AGGREGATED WEIGHTED VARIABLES IN THE MULTIPLE REGRESSION ANALYSIS*

	COLL	COMP	OVI	ETH1	ETH3	MD	ES	MAJ	YR
COLL	1.000	- .689	.446	- .240	- .207	.048	- .059	.152	.064
COMP	- .689	1.000	- .575	.664	.187	- .093	- .005	- .173	- .063
OVI	.446	- .575	1.000	- .351	.025	.179	.092	.386	- .151
ETH1	- .240	.664	- .351	1.000	- .197	- .136	- .062	- .018	- .102
ETH3	- .207	.187	.025	- .197	1.000	.033	.020	.228	- .169
MD	.048	- .093	.179	- .136	.033	1.000	.044	.152	- .057
ES	- .059	- .005	.092	- .062	.020	.044	1.000	.244	- .286
MAJ	.152	- .173	.386	- .018	.228	.152	.244	1.000	- .256
YR	.064	- .063	- .151	- .102	- .169	- .057	- .286	- .256	1.000

*$r \leq .195$, $p = .05$

$r \leq .254$, $p = .01$

TABLE 29

MULTIPLE REGRESSION RESULTS FOR LOGIT FUNCTION PREDICTING SURVIVAL BY NROTC COLLEGES[a]

Variable	B	Std. Error	F
X_1 = Level of Competitiveness	-0.0885	.0226	15.284*
X_2 = Overall Index	0.3349	.0822	16.602*
X_3 = Early Selection	5.4256	1.4725	13.576*
X_4 = White Male	-0.7205	.2206	10.670*
X_5 = Composite SAT	.0008	.0004	3.339

[a] r^2 = .323
standard error = .184
d.f. = 5/170

*significant at the .01 level

The analysis resulted in the fitted equation:

$$\ln \frac{p}{1-p} = -.2599 - .0885 X_1 + .3349 X_2 + 5.4256 X_3$$

$$-.7205 X_4 + .0008 X_5 + .1842$$

DISCUSSION

The data which have been presented in the study using the NROTC Class of 1981 as a case study hold important implications in assaying the future supply of NROTC officers, especially if the current mix constraints remain in effect. It would appear that the Navy must monitor closely the impact of the declining population of college-bound youth as it applies to NROTC, and that controllable factors such as mix constraints must be validated in terms of officer corps requirements in order to ensure that the Navy does not further and artificially restrict the already dwindling supply. Attrition, too, must be given close attention if program costs are to be minimized and fleet requirements met.

IMPLICATIONS OF DECLINING POPULATION DURING THE APPLICANT PHASE

Overall Impact

Applying the supply model operators derived from the Class of 1981 applicants, the implications of the population of young people entering college declining to 1,600,000 in the mid-1980's are considerable. If the interest factor remains at 1 percent, 16,000 students can be expected to apply for NROTC. If approximately 40 percent qualify as finalists, as with the Class of 1981, approximately 6400 finalists can be expected. If approximately 30 percent of finalists is eliminated due to failure to report for processing, health, etc., the

population of students to whom scholarships can be offered will be approximately 4500. The practical implications are that, whereas approximately one-third of the Class of 1981 finalists was not offered scholarships, even though they successfully passed screening, this sort of quality selectivity will not be possible under the declining population scenario. With a declination ratio of approximately 40 percent, practically all finalists who pass screening must be offered a scholarship in order to achieve a class-size on the order of 2,000. The implication of the analysis in terms of gross numbers alone is that selection on the basis of mix constraints will not be possible. This implication is examined in the following sections.

Technical/Nontechnical Mix Impact

If the population of entering college freshmen declines to 1,600,000, as previously stated, a pool of approximately 800,000 males will exist. If, as in 1977, 30 percent of these males is inclined toward a technical major, the pool of male technical majors will number approximately 240,000. If only 1 percent of these males is interested in NROTC, only 2,400 males intending to major in technical subjects will apply for NROTC. Assuming approximately 30 percent of the finalists fail screening, approximately 1,680 will be eligible for scholarships. If 40 percent decline the scholarship, approximately 1,008 males desiring technical majors will enter the NROTC class.

Another way of viewing the impact of the declining population of college-age youth on the technical/nontechnical mix is to consider that if 95 percent of an entering class of 2000 students is to be males of whom approximately 80 percent must be technical majors, approximately 1520 males with technical majors must enter school. If 40 percent of those offered a scholarship declines, approximately 2533 must be offered a scholarship in order to attain an input of 1520. In order to offer 2533 scholarships, approximately 3,618 finalists are required since, approximately 30 percent is eliminated during screening. If only 40 percent of applicants achieve finalist status, approximately 9,062 males intending to major in technical subjects must apply in order to achieve the desired male-technical major mix. This figure equates to quadrupling the interest factor of 1 percent and recruiting 1 of every 26 from the pool of college-bound males intending to major in technical areas. This is a very conservative ratio because it assumes that every male-technical major finalist who passes screening will be offered a scholarship regardless of relative quality. The most optimistic conclusion which can be reached is that achieving the desired technical/nontechnical mix in an NROTC class is going to become extremely difficult as the population of college-age youth declines.

1200/650 Mix Impact

Analysis of the 1977 population of college-bound youth taking the SAT indicated that approximately 6 percent of the

population can be expected to achieve a 1200 Composite and a 650 mathematics score on the SAT. From a population of 1,600,000 students, this equates to a pool of 96,000 students. If the input to each class of approximately 2,000 students must include 1,600 1200/650 achievers, and following the path of analysis used in the previous section, approximately 10,000 applicants from the pool of 1200/650 achievers will be required to meet this condition. The interest factor would have to be over 10 percent and equates to recruiting 1 of every 10 students in the pool of 1200/650 achievers. Recall that in 1977, the Navy did not achieve the desired 1200/650 mix in the Class of 1981 (recruited in 1977) despite the fact that the finalist population included 3,799 students who achieved the 1200/650 criterion. According to the hypothetical analyses conducted thus far in this section 3,799 finalists should have achieved the required input mix. That the desired input mix was not achieved indicates that either more than 30 percent of this population failed screening, not all qualified 1200/650 achievers were offered a scholarship, or more than 40 percent declined scholarship offers. For whatever reason, experience with the Class of 1981 1200/650 finalists would indicate that the projections in terms of gross numbers, technical/non-technical mix, and 1200/650 mix contained in this section are conservative in estimating the number of finalists required to achieve the respective desired inputs. While the recent lowering of the finalist screen to 950/520 for all candidates will increase the number of finalists, it should be clear that

the current technical/nontechnical and 1200/650 mix goals are going to have increasingly restrictive impact on the supply of NROTC officers as the population of college-age youth declines.

The impact is even more dramatic when one considers the fact that in order to meet the current mix constraints, a large part of the supply of NROTC students is drawn from the population of males who are both technical majors and who possess a 1200 SAT composite score and a 650 mathematics score. While the data presented in Table 24 show that college major and SAT scores are correlated to a degree, if one assumes that college major and SAT scores are independent, the worst case probability of a male desiring a technical major and possessing a 1200/650 SAT score can be calculated as the product of each event's respective probability. Using the 1977 probabilities for male technical majors and male 1200/650 achievers, the worst case probability of a male desiring a technical major and possessing a 1200/650 SAT score is .3 multiplied by .13, or 3.9 percent. If the population of college freshman age males falls to 800,000, approximately 31,200 males will meet both the technical major and 1200/650 criteria in the worst case. If the interest in NROTC remains at 1 percent, approximately 312 of these male students will apply for NROTC.

The speculative figures presented in this section are not intended to portray impending doom for the NROTC. The intent is to demonstrate that with the population of youth declining

in the United States, the Navy faces a very critical recruiting problem if current qualitative mix constraints are to remain in effect. Hopefully, the data demonstrate that future qualitative requirements will have to be closely balanced with quantitative availability.

EFFECTS OF ATTRITION DURING THE STUDENT PHASE

Attrition on an Individual-Case Basis

The principle conclusions which can be reached from the data presented in this study concerning attrition during the student phase are that the attrition rate is high (Class of 81, 47%; Class of 82, 41%), that the vast majority of attrition is voluntary (Class of 81, 91%; Class of 82, 87%), and that the majority of attrition during the first two years occurs during the sophomore year (Class of 81, 62%; Class of 82, 73%). There can be little doubt that the timing of the military obligation point at the beginning of junior year has a major impact on the timing of voluntary attrition. Analysis on the basis of sex/ethnic background, college level of competitiveness, overall index, college major, and composite SAT score showed the ability to discriminate to a small degree between freshman year attritees and sophomore year attritees. Other than the case of students with SAT composite scores between 1150 and 1199 discussed below, analysis of attrition on an individual-case basis lent little else of a positive nature to the analysis of attrition.

The 80/20 technical/nontechnical mix criterion is apparently not impacting on attrition. If technical majors were attriting at markedly different rates than were nontechnical majors, one might conclude that adjusting the mix would alter the overall rate--that is not the case, however. By the same token, the 80/20 1200/650 mix criterion does not appear to be impacting on attrition, although the reader should be reminded that for the Class of 1981 on whom the analysis was conducted, the 1200/650 mix was closer to 60/40. Had the mix actually been 80/20, attrition might have been higher. It was pointed out, for instance, that among students in the Class of 1981, the population of students having an SAT composite score of between 1150 and 1199 was the only such category showing a propensity to survive to junior year markedly above 50 percent. The same trend occurred in the Class of 1982, where students in the 1150-1199 range showed a 62 percent survival rate, as was the case in the Class of 1981.

The failure of the variables used in this study to predict individual attrition to any significant extent points out that the causes of attrition may not be very individualistic and fall into categories other than those depicted by the variables in this study.

Attrition Using the College as the Level of Analysis

Aggregating data on a college basis yielded some interesting insights into NROTC attrition. Perhaps the most telling was the fact that when the quality of the college

goes up, as measured by the academic quality of the entire student body, NROTC attrition goes down. One of the interesting folklore hypotheses that this would seem to discount is that at high quality institutions where the student body is likely to be recruited heavily by commercial employers, the peer pressure on NROTC students to aspire to relatively higher paying employment contributes to NROTC attrition. Nor can the phenomenon be attributed to the ethnic background of the NROTC students attending colleges having lower levels of competitiveness: 90 percent of students entering level 3 and 4 colleges was white males which is roughly equal to the 92 percent which entered level 1 and 2 colleges. However, colleges having a larger proportion of white males encountered significantly lower survival rates.

Another interesting result of analyzing data on the college level was that as the quality of the student improved in terms of the Overall Index, the probability of survival went down. Examination of the correlation matrix in Appendix A shows that a small but significant relationship exists between OVI and College Level of Competitiveness. The correlation of OVI with category 1 was -.045 ($p = .033$), with category 2, -.014 ($p = .291$), and with category 3, .042 ($p = .042$). These correlation coefficients indicate that students of high quality in terms of OVI tend to attend high quality schools in terms of level of competitiveness. This tendency results in an apparent contradiction of the previous conclusion that a

decrease in survival rate occurs as college level of competitiveness goes down. Since even at highly competitive colleges the NROTC unit includes students with both high and low OVI scores, the explanation may be that those students with high OVI scores are the attritees. It is difficult to hypothesize the basis of this phenomenon, but it does point out the need for more research and analysis to determine what OVI is actually measuring. These observations involving OVI are in direct contrast to early selection status which appears to contribute significantly to overall survival to junior year.

Regardless of the exact causal relationships between attrition and the variables used in this study, the results of the analysis of attrition using the college as the level of analysis point out that the college in which a student is enrolled does have a bearing on the student's remaining in the program. Whether the student is able to attend the college of his choice may be an important variable in attrition at the college level. It may be that there are differences in the colleges themselves that are important to attrition, such as whether the colleges are public or private institutions. Recalling that the weighting factor used in this study eliminated the size of the college as a factor in the analysis, the size of the student body may in actuality impact on attrition. Likewise, there may be differences in administrative policy among the NROTC-sponsoring colleges that contribute to attrition.

At the NROTC unit level, the quality of the Professor of Military Science and his staff may be an important variable in unit attrition. This factor could be tremendously important if there are differences among the colleges in terms of the qualifications required to be met by potential NROTC instructors, or if some colleges are considered by potential NROTC instructors to be more preferable in terms of career enhancement, for instance. Whether the college allows NROTC instructors to enroll in university graduate programs might exert influence on the quality of officers seeking assignment to the college, which in turn might impact not only on the quality of instruction in the NROTC unit, but also the degree to which the NROTC student desires to be a member of the Naval officer corps as exemplified by his or her instructors. These "possibilities" are of course speculative, but the analysis of attrition by college clearly shows that the assignment of a student to a particular college is significant to the probability of his remaining in the NROTC program.

Proposals for Further Research

This study has revealed a great deal concerning the operators impacting on the supply of NROTC officers; however, it has also revealed several areas in which further research offers the potential for ensuring that the policies governing the NROTC are consistent with the Navy's needs. In considering future analysis in the NROTC area, what must not be lost sight of is the fact that NROTC was developed to support the

needs of naval operating forces afloat and ashore, and it is within that context that any analysis should be conducted. For example, to fill an NROTC class with students majoring in zoology because zoology majors show a high propensity to remain in the NROTC Program makes sense only if zoology majors can operate nuclear submarines, Aegis destroyers, or F-14's as well as anyone else with training and experience. BDM Corporation in its 1978 Report on the NROTC Program recommended that analysis be conducted surrounding the 80/20 technical/ nontechnical mix, focusing on the curricula at naval warfare schools, the technical requirements of naval weapons systems, and a survey of technical graduates as to their feelings on the Navy's utilization of their education (BDM Corporation, 1978). Little substantive information is likely to be gained from such analysis, however. Navy warfare schools seldom have time to teach the technical detail required for an officer to properly do his job: much learning is left to the initiative of the officer and the natural learning that occurs in the operational environment. Likewise, there can be no doubt that naval weapons systems are tremendously technical. The question of course is how much undergraduate technical education is required for an officer to successfully complete the warfare courses and operate Navy systems. It may be that a bright, motivated officer with a nontechnical undergraduate major is just as capable as an officer with a technical major. A survey of technical officers is also likely to be of limited value in

evaluating the 80/20 mix criteria if, as the Chief of Naval Operations suggested in the policy statement which established the 80/20 criterion, much of the gain in a technical discipline comes from problem-solving techniques and logical thought processes (NROTC Education and Training Policy, 1976). On this basis, it would be difficult to conclude that because a survey revealed that naval officers who are technical graduates seldom employ integral calculus in their jobs, the Navy's need for technical graduates is inflated. On the other hand however, one should not necessarily dismiss all nontechnical disciplines as failing to contribute to logical thought processes or orderly decision-making. The focus in future research then should be on validating the requirement for technical undergraduate education in the Navy, and secondly validating the ratio of technical to nontechnical undergraduates required.

Validating the Navy's need for officers with undergraduate technical education presents a criterion problem. The Center for Naval Analysis has conducted two studies (Fletcher, 1977; Fletcher, 1978) attempting to compare the commissioned service achievement of technical and nontechnical undergraduate majors using command tours, graduate education, awards and decorations, and promotions to Lieutenant, Lieutenant Commander, Commander, and Captain as the measures of success. Based on officer performance in the period FY 1973-FY 1975, these studies concluded that officers with technical backgrounds

have no more successful careers, using these criteria, than do officers with nontechnical backgrounds. The major shortcoming to these studies are that with the possible exception of promotion rates, the measures of success are poor surrogates for success. The awarding of decorations is very subjective, and command tours and promotion are often a function of supply and demand. Unfortunately, measures of success on an individual basis are difficult to define. What is needed is a measure to provide insight into where technical undergraduate background is needed and not needed in order to establish a valid technical/nontechnical mix at the undergraduate level. That is to say, it should not be assumed that the nuclear power, surface, aviation, and engineering duty communities for instance have the same demand for undergraduate technical majors. Future research in this area should center on the operational environment. An experiment could be designed to evaluate the operational records of a wide range of ship classes in similar operating environments and compare the technical/nontechnical mix of officers in those ships. Measures of operational readiness such as days underway days inport due to system casualties, number of system casualties as reflected in Casualty Reports, and desertion and unauthorized absence rates, to name a few, are available, which, when viewed in terms of the technical/nontechnical mix of the officers assigned, may yield useful insight into the degree to which the number of officers with technical undergraduate majors correlates with operational success. As

opposed to a controlled experiment with 2 ships, using a large number of ships categorized by ship class would de-emphasize effects such as the particular assignment held by each technical/nontechnical officer and the degree to which the performance of previously assigned officers impacted on the current operational readiness of the ship. The same kind of experiment could be tailored to aviation squadrons.

In the area of NROTC itself, the most glaring need in future research is to conduct a study which follows NROTC classes including lateral entry students through college and into commissioned service through 2 years beyond service obligation. The need arises in that data such as that used in this study are cross-sectional, covering only a short period of time. In order to make valid forecasts of future NROTC attrition and in order to evaluate the effect of policies surrounding the NROTC Program, longitudinal data are necessary to give a complete historical picture of the attrition process. The Class of 1981 offers the first real opportunity to do this since it is the first class on which an automated data base has been constructed. Data are being collected on subsequent classes as well and will provide the opportunity to cross-validate findings.

Several options exist for research aimed at keeping more students in the NROTC program. Determining the characteristics of the large population of students who decline NROTC scholarships and why they do so may be especially productive.

Knowing who declines the scholarship might allow the Navy to better focus its recruiting attention, and knowing why the scholarship is being declined might point out areas where changes in the program would increase the supply of students. This study also suggests that another area bearing attention is the characteristics of the NROTC-sponsoring colleges, as well as the policies surrounding the assignment of both NROTC staff and students to a particular college. Research tracking the population of students having SAT composite scores between 1150 and 1199 may also prove productive. If a consistently higher than average propensity to remain in the NROTC program is confirmed for these students, adjustments of screening methods or the SAT mix criteria may prove beneficial.

CONCLUSIONS

The major conclusions arrived at as a result of this study are:

(1) If the population of college freshman age males falls to 800,000, based on 1977 data approximately 2,400 males intending to major in technical curricula will apply for NROTC, while approximately 9,062 male applicants intending to major in technical curricula will be required to maintain the currently desired male-technical major mix.

(2) If the population of college freshman age youth falls to 1,6000,000, based on 1977 data, the Navy will need to recruit 1 of every 10 SAT 1200/650 achievers in order to maintain the currently desired SAT score mix.

(3) If the trends demonstrated in 1977 continue through the 1980's the worst case probability of a male desiring a technical major and achieving a 1200/650 SAT composite/mathematics score will be .039. If interest in NROTC remains at 1 percent of the population, approximately 312 of approximately 800,000 college freshman age males meeting both of the above criteria can be expected to apply for NROTC.

(4) Based on NROTC Class of 1981 attrition through the junior year, the 80/20 technical/nontechnical mix criterion does not appear to be impacting on program attrition.

(5) Based on the Class of 1981 data, it is possible to discriminate between freshman year attritees and sophomore year attritees using various sex/ethnic background and qualitative variables (see Table 27).

(6) Based on the NROTC Classes of 1981 and 1982, when students are categorized by levels of SAT composite scores, only the population of students with a score between 1150 and 1199 show a markedly higher than .5 probability of surviving to the junior year.

(7) The college to which a student is assigned does have an impact on a student's decision to leave or stay in the NROTC program.

APPENDIX A

This appendix shows the Pearson correlation coefficients for the independent variables used in the analysis of attrition. The significance of each coefficient is shown in parentheses.

	R1	R2	M1	C1	C2	C3
R1	1.00 (0.0)	.662 (0.0)	- .017 (.245)	.017 (.250)	.009 (.350)	- .018 (.234)
R2	.662 (0.0)	1.00 (0.0)	- .012 (.313)	.015 (.270)	- .021 (.194)	- .007 (.383)
M1	- .017 (.245)	- .012 (.313)	1.00 (0.0)	.021 (.196)	.039 (.055)	- .069 (.002)
C1	.017 (.250)	.015 (.270)	.021 (.196)	1.00 (0.0)	- .373 (0.0)	- .443 (0.0)
C2	.009 (.350)	.021 (.194)	.039 (.055)	.372 (0.0)	1.00 (0.0)	- .566 (0.0)
C3	- .018 (.234)	.007 (.383)	- .069 (.002)	.443 (0.0)	- .566 (0.0)	1.00 (0.0)
MD1	- .040 (.049)	- .011 (.333)	- .024 (.168)	.040 (.052)	- .093 (0.0)	.065 (.004)
SL1	.028 (.129)	.025 (.152)	.047 (.028)	.256 (0.0)	- .011 (.323)	- .189 (0.0)
SL2	.022 (.189)	.026 (.149)	.022 (.184)	- .009 (.353)	.013 (.301)	.008 (.372)
SL3	.016 (.258)	.022 (.187)	- .056 (.012)	- .064 (.005)	.014 (.289)	.033 (.087)
SL4	- .057 (.010)	- .056 (.007)	- .020 (.206)	- .084 (0.0)	.201 (.199)	.058 (.008)
SL5	- .021 (.196)	- .020 (.208)	- .011 (.331)	- .133 (0.0)	- .018 (.227)	.103 (0.0)
SL6	- .021 (.196)	- .030 (.110)	- .027 (.138)	- .100 (0.0)	- .022 (.184)	.092 (0.0)
ST1	.023 (.175)	.046 (.031)	.044 (.035)	.004 (.440)	.034 (.083)	.043 (.041)
ST2	- .022 (.184)	- .020 (.203)	- .036 (.070)	- .037 (.065)	.020 (.211)	- .012 (.312)
ST3	- .009 (.364)	- .022 (.181)	- .028 (.126)	.011 (.329)	- .057 (.010)	.051 (.019)
ST4	- .004 (.428)	- .029 (.118)	- .009 (.362)	.016 (.263)	- .009 (.365)	.015 (.265)
OVI	- .007 (.391)	.018 (.232)	- .025 (.158)	- .045 (.033)	- .014 (.291)	.042 (.042)

	MD1	SL1	SL2	SL3	SL4	SL5	SL6
MD1	1.00 (0.0)	- .010 (.328)	- .008 (.366)	- .030 (.108)	.024 (.163)	.026 (.145)	.022 (.181)
SL1	- .011 (.328)	1.00 (0.0)	- .355 (0.0)	- .346 (0.0)	- .219 (0.0)	- .253 (0.0)	- .181 (0.0)
SL2	- .008 (.336)	- .355 (0.0)	1.00 (0.0)	- .253 (0.0)	- .160 (0.0)	- .185 (0.0)	- .133 (0.0)
SL3	- .030 (.108)	- .346 (0.0)	- .253 (0.0)	1.00 (0.0)	- .156 (0.0)	- .180 (0.0)	- .129 (0.0)
SL4	.024 (.163)	- .219 (0.0)	- .160 (0.0)	- .156 (0.0)	1.00 (0.0)	- .113 (0.0)	- .082 (0.0)
SL5	.026 (.145)	- .253 (0.0)	- .185 (0.0)	- .180 (0.0)	- .114 (0.0)	1.00 (0.0)	-.094 (0.0)
SL6	.022 (.181)	- .181 (0.0)	- .133 (0.0)	- .129 (0.0)	- .082 (0.0)	- .094 (0.0)	1.00 (0.0)
ST1	- .089 (0.0)	.059 (.008)	.055 (.013)	.018 (.229)	.006 (.404)	- .033 (.088)	- .197 (0.0)
ST2	- .002 (.472)	- .091 (0.0)	- .055 (.012)	- .030 (.112)	- .025 (.157)	.011 (.328)	.330 (0.0)
ST3	.118 (0.0)	- .066 (.004)	- .037 (.064)	- .026 (.146)	.011 (.322)	.068 (.003)	.129 (0.0)
ST4	.015 (.272)	.036 (.073)	- .012 (.311)	.007 (.385)	.000 (.487)	- .016 (.257)	- .040 (.050)
OVI	- .001 (.496)	- .133 (0.0)	- .049 (.022)	- .023 (.170)	.039 (.058)	.120 (0.0)	.171 (0.0)

	ST1	ST2	ST3	ST4
ST1	1.00 (0.0)	- .410 (0.0)	- .584 (0.0)	- .637 (0.0)
ST2	- .410 (0.0)	1.00 (0.0)	- .024 (.160)	- .027 (.140)
ST3	- .584 (0.0)	- .024 (.160)	1.00 (0.0)	-.038 (.061)
ST4	- .637 (0.0)	- .027 (.140)	- .038 (.061)	1.00 (0.0)
OVI	- .100 (0.0)	.212 (0.0)	.022 (.187)	- .009 (.365)

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